NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OF ENVIRONMENTAL SCIENCE

DEPARTMENT OF GEOSPATIAL SCIENCE

BACHELOR OF SCIENCE (HONOURS) DEGREE IN GEOGRAPHICAL INFORMATION SYSTEMS (GIS) AND REMOTE SENSING IN NATURAL RESOURCES MANAGEMENT

INTRODUCTION TO SPATIAL STATISTICS

EGR 2204

Regular Examination Paper

March 2025

This examination paper consists of 4 pages

Time Allowed: 3 hours

Total Marks: 100

Examiner's Name: Mr Bukhosi Ngqabutho Khumalo

External Examiner: Dr M Shekede

INSTRUCTIONS

1. Answer QUESTION **ONE** AND ANY **THREE** OTHERS
2. Each question carries 25 marks

MARK ALLOCATION

QUESTION	MARKS
1.	**25**
2.	**25**
3.	**25**
4.	**25**
5.	**25**
6	**25**
TOTAL	**100**

1. The following table shows the coordinates of 5 points in a study area

Table 1: X and Y cordinates of 5 points

Point ID	X Coordinate	Y Coordinate
1	2	4
2	3	5
3	5	7
4	7	8
5	8	9

a) Using Table 1 above, calculate the **mean center** and **standard distance. [10 marks]**

b) Interpret the results of the mean center and standard distance in the context of spatial distribution. **[5 marks]**

c) Discuss how the mean center, standard distance, standard deviational ellipse, median center and central feature can be applied in wildlife management. **[10 marks]**

2. a) Explain **Tobler's First Law of Geography** and its relevance to spatial autocorrelation. **[5 marks]**

b) Assess the validity of the Tobler's First Law of Geography. **[20 marks]**

3. a) Describe the main methods of point pattern analysis. **[10 marks]**

b) What are the main spatial point patterns and the associated spatial processes they are generated from? **[15 marks]**

4. b) Compare and contrast global and local spatial autocorrelation. **[10 marks]**

b) Describe how we can interpret the results of the Global Moran's I index. **[15 marks]**

5. The following table shows the values of two variables (X and Y) for four regions

Table 2 : X and Y values for 8 regions

Region	X (Independent)	Y (Dependent)
A	10	20
B	20	30
C	30	40
D	40	50
E	15	-
F	22	-
G	24	-
I	11	-

a) Perform an Ordinary Least Squares (OLS) regression to model the relationship between X and Y and complete Table 2 above. [10 **marks**]

b) Explain how Geographically Weighted Regression (GWR) differs from OLS and when it would be more appropriate to use. [5 **marks**]

c) Using the OLS regression results you calculated in part 4a, describe the following components of a regression equation

i. Dependent Variable. [2 **marks**]

ii. Independent Variable . [2 **marks**]

iii. Intercept . [2 **marks**]

iv. Slope. [2 **marks**]

v. Residual . [2 **marks**]

6. Define the following terms

a) Complete Spatial Randomness. **[5 marks]**

b) General G-Statistic. **[5 marks]**

c) Incremental Spatial Autocorrelation . **[5 marks]**

d) Hot spot and Cold spot. **[5 marks]**

e) Getis-Ord Gi and Gi * **[5 marks]**

END OF EXAMINATION